French engineers are investigating the territory from the starting-point of the future line to the Laghouat in the south. From that point as far as the line from Ain Sala au Khat military-technical expeditions are to prepare the way. Besides this the Oran Geographical Society and the Vice-Prefect of Tlemcen are to send caravans along the frontier of Marocco. MM. Soleillet and Duveyrier will travel on their own account for the same object.

A MEETING took place at Dortmund on the 4th inst., which had for its object the discussion of a project for connecting the Rhine and the Weser by means of a canal. The Government presidents of Westphalia, of the Rhineland, and of Hanover were present. The canal will be constructed *viâ* Ruhrort and Heinrichenburg, but it is undecided as yet whether from the latter place it will proceed to Emden or to Minden. Special committees were formed for the purpose of further investigating the latter question.

MESSRS. SCHMIDT AND GÜNTHER, of Leipzig, will shortly publish an elaborate work on India by Emil Schlagintweit. The work will appear in thirty-five parts, and will be profusely illustrated by eminent artists.

A PARLIAMENTARY caravan comprising about twenty members of the French Senate and Chamber of Deputies is travelling all over Algeria in order that the legislators may become acquainted with the peculiarities of the land and inhabitants. The tour will be terminated at the end of the month.

THE PLANETS OF THE SEASON

SELDOM could the aspect of the nocturnal sky be more attractive to the student of planetary phenomena; seldom has his inquiring gaze been repelled more pertinaciously by

"Vapours and clouds and storms,"

than during the past anomalous season; and our English climate has more than maintained its accustomed forbidding character, just when a few nights of transparency would have been especially welcome. Better things, however, may still be in store; and in that hope the following remarks on the distinctive features of the present ornaments of our midnight sky may be admissible as possibly of some suggestive value to comparatively inexperienced observers.

We have for some time past had a simultaneous presentation, under the favourable circumstances of proximity to the earth and a greatly improved altitude as compared with recent oppositions, of three peculiarly remarkable objects, the most magnificent, the most ornate, and—so to speak, the most earth-like member of the planetary family. Each holds his own pre-eminence on his own ground; each bespeaks especial study from his own individual character; and it is probable that some acquaintance with foregone results may economise time and labour by enabling us to leave on one side what is already, in comparison, sufficiently known.

The examination of Jupiter is not at present quite as satisfactory as it would be with as much north as he has south declination; it is always, however, greatly facilitated by the broad expanse of his noble disk, and a brilliancy so great as to have occasioned a suspicion of unborrowed light, emanating from internal incandescence. While, however, the shadows of the satellites upon his surface are so intensely black, and the satellites themselves so utterly invisible in eclipse, it is evident that any accession of luminosity from such a cause, even if it exists, must be quite insensible in the general effect, which can only be ascribed to an extraordinary reflective power in the whiter portions of the globe. A diminution of brightness towards the limb, which might be anticipated on optical grounds, and is frequently demonstrated by the reversal of the aspect of a passing satellite from light to dark, or the contrary, is nevertheless not distinguishable by the eye, nor even when a portion of the light has been intercepted by darkening glasses; it is, however, apparent if the screen is deep enough in tint to extinguish the satellites. This was scarcely to be expected. It might have been supposed that a central region so bright as to exhibit a white disk in front of it as dark, even to blackness, by contrast, could not escape being itself strongly contrasted with a border so much fainter that the same disk appears luminous on it as a background. Yet the difference is not obvious; and no other cause can be assigned excepting the imperceptible gradation. The idea of absorption in the upper region of an extensive atmosphere, not otherwise manifesting its existence, has indeed been entertained; but it seems unnecessary. The observed decrease of brilliancy is only what would result from obliquity of incidence in the solar rays, and it probably exists in no greater proportion than is due to that cause. The atmospheric hypothesis might indeed have been directly tested, by comparing the brightness of the satellites when near the limb in the superior and inferior portions of their orbits, had their light been sufficiently equable; but its variations are too evident and at the same time too irregular to render such comparisons satisfactory. A long course of observation might indeed eliminate these discrepancies, but it is questionable whether the result would repay the labour. Nevertheless the fact referred to, of the incompetence of, at least, ordinary vision to detect the diminution of light towards the limb is worth attention, as leading to inferences rather unfavourable to the sensitiveness of the eye in some of the processes of photometry. At a considerable distance from opposition, when the terminator encroaches slightly on the elliptical form of the limb, the defalcation of light on that side may be readily detected.

As to the real nature of that magnificent globe we are compelled to admit an embarrassing amount of ignorance. We see indeed that it is encompassed by an envelope, subject to occasional disturbances of a nature which on our earth would necessarily infer the extensive prevalence of vapour, sometimes in tranquil suspension, at others either agitated by rapid currents, or subject to equally speedy processes of precipitation and solution. Beyond this we can hardly be said to know anything. Jupiter is in no respect an enlarged resemblance of the earth. With so little similarity in point of density and gravitation—with so slight a diversity of seasons—with such rapid interchange of day and night—could we be transported there, we might probably find ourselves as among the imagery of an incomprehensible dream. Vapour we might recognise—and vapour occasionally in a state of rapid change; but possibly not the vapour of water; and whether exhibiting itself in the luminous or shady spaces could hardly be decided by a mere comparison with terrestrial clouds. These would no doubt be to a distant eye brighter than the surface beneath them, but among so much that is dissimilar a single point of analogy would hardly bear much weight; it is, however, the more probable alternative that the dark bands are the transparent part of the atmospheric envelope, from the fact that these become less distinct towards the limbs. The obliteration is not indeed always apparent, and is often absolutely imperceptible in a sharply defining instrument; but it has been frequently referred to, and if these ideas are correct, it may probably be found that in proportion to the darkness of the belts will be the nearness of their approach to the edge of the disk. The disappearance of dark spots near the limb would be accounted for by the rules of foreshortening in perspective.

The tendency to an equatorial arrangement in these streaks is one of the most familiar features of the planet; and almost self-evidently connects itself with the astonish-

ing velocity of rotation; yet there is a "missing link" which cannot readily be supplied. Friction against a surrounding medium, *combing out*, as it has been expressed, the vapours in a longitudinal direction, can hardly be admitted on mechanical grounds; and there is difficulty in conceiving the arrangement of the restoration of equilibrium in currents which set in one direction over the whole visible globe, if they originate by ascending from warmer depths, and lagging behind in a higher and more swiftly rotating region. We may remark, in passing, that only a trifling elevation of the luminous above the grey region, with a corresponding slight difference in velocity of rotation, is compatible with the undeviating contour of the limb as far as our telescopes may show it; though, of course, given an unlimited duration of time, the slightest preponderance would be ultimately adequate to such an effect. Possibly the best explanation may lie in some modification of electrical or magnetic polarity. At any rate the influence, though predominant, is not irresistible, since it neither precludes the formation of belts of a certain amount of obliquity, nor mixes up in confusion, though it seems to elongate, those very remarkable insulated luminous masses which occasionally encompass the gigantic equator in a comparatively equable series with a string of great oval beads, sometimes so curiously and uniformly shaded as to convey an almost irresistible impression of high relief. This strange phenomenon, not confined, as Dawes has found, solely to the equator, seems wholly beyond our conjectures. Nor can we satisfactorily explain those large spots, much darker than the belts, as though the atmosphere were there more perfectly transparent, which have occasionally shown such remarkable persistency as to indicate some relation to definite regions on the surface beneath them; at other times have disappeared with startling rapidity; and usually have been so far from absolute immobility that every attempt to determine the rotation by their means has ended in mere approximation. The occasional detection, too, of many minute white specks, like passing satellites, in various parts of the disk, has added nothing to our knowledge beyond the fact of their presence. The abnormal flattenings of the limb which have sometimes been noticed on the approach of a satellite, or even without it, seem to be of an illusory nature. And yet nothing should pass without attention.

Few things in this wonderful planet are more striking than the singular and beautiful colouring which occasionally adorns the disk. For a considerable season nothing beyond some feeble tinge may be made out, especially in the equatorial zone; then again we shall find purple, brown, greenish yellow, orange, and rosy tints marking out the surface with delicate but unmistakable variety. The darker the grey of the belts, the more apt it is to show a slaty purple hue; the polar regions sometimes, as at present, differ slightly in tint, so that temperature does not seem to be connected with it. The rosy spot of the present season south of the equatorial zone has naturally attracted much attention, and will of course be carefully watched. But as yet the origin of such varieties of colour sets conjecture at defiance. To depict these many changes both of form and hue will always be an interesting occupation, though it is never likely to have any more definite result than to deepen our sense of the wonders of creation, and our reverence for its First Great Cause.

One caution may be permitted here. It would be very desirable for those who attempt to delineate this magnificent planet that they should make themselves familiar with the perspective of a globe. The telescopic image has so precisely the aspect of a flat disk that it requires some mental effort to realise the fact that we are gazing on a great ball; and unless this is carefully borne in mind our drawings will and must be unsatisfactory. Especially it is perhaps seldom imagined how very little we know of the Polar regions, from an obliqueness of presentation amounting to virtual and unbroken concealment. From the analogy of Saturn we may infer that the poles of Jupiter present no remarkable feature; but it must ever remain a mere conjecture to all future generations.

It scarcely needs to be mentioned that no circular representation of the disk can ever give a resemblance tolerable to an experienced eye. An elliptical outline, apparent even with a power of 30 or 40, is too striking a characteristic not to affect materially the faithfulness of the picture.

Something remains to be said as to the beautiful retinue which attends on this leader of the planetary system and whose perpetual change of configuration is ever a source of fresh interest. In some respects they are subjects only for the finest telescopes, in others a very slight optical power can deal with them. The true dimensions of those minute disks are, perhaps, as fairly known as can be expected from measures of such difficulty; but the subject of their numerous changes of brilliancy, though frequently treated, cannot be said to be fairly exhausted. That such changes exist, and to an extent easily recognised in very moderate telescopes, is undeniable; and were they constant for the same orbital positions, they would find ready explanation in the very natural supposition that they rotate like our own satellite, each on his own axis, in the same time that they complete their monthly period. But this idea, though it approved itself to Herschel I. and Schröter, is found inconsistent with observation, which shows the changes to be too irregular in their returns; and we can only infer, what, indeed, has been actually shown by good instruments, both in front of and outside of the face of the primary, the variable darkening of portions of their disks, a result which, interpret it how we may, by atmospheric change, or unsymmetric rotation, or a combination of both (and no other supposition seems to occur), removes those little bodies still further from our analogies. There is no more resemblance between these satellites and our moon than there is between the primaries on which they respectively attend.

We must postpone our remarks on Saturn and Mars to a future opportunity.

T. W. WEBB

NORDENSKJÖLD'S ARCTIC VOYAGES[1]

IT is fifteen months, our readers will remember, since Prof. Nordenskjöld left Hammerfest in the *Vega* to prove that, if taken at the proper time, the North-East Passage is perfectly practicable. And the result has proved that he was right to within a day or two. Nearly a year ago he had practically accomplished the passage, and was only overtaken by the ice just as he was about to emerge into the Pacific. We know already that during their year's enforced imprisonment in the ice to the east of Serdze Kamen, Prof. Nordenskjöld and his accomplished and well-selected staff have made the best possible use of their time. We have already, on several occasions, briefly referred to some of the valuable results obtained in various departments of science, and the full narrative of the expedition will be looked for with impatience. We hope that it will be given to the world with the least possible delay after the leader's return to his home in Stockholm. Meantime we are concerned, not with this culmination of a long series of expeditions in the Arctic waters to the north of the Old Continent, but with the exploring work of its leader during the previous twenty years. Mr. Leslie has done good service in wading through the voluminous literature of Nordenskjöld's various expeditions, and culling from it the material wherewith to compile a

[1] "The Arctic Voyages of Adolf Erik Nordenskjöld, 1858–1879." With Illustrations and Maps. (London: Macmillan and Co., 1879.)